

Light Rail Transit Accommodation

Introduction

How is light rail transit accommodation addressed in the preferred alternative?

The Washington State Department of Transportation received significant comment during the SDEIS public comment period regarding the ability of the SR 520 corridor, as analyzed in the SDEIS, to accommodate light rail transit (LRT). It must be noted that the SR 520 I-5 to Medina Bridge Replacement and HOV Project scope does not specifically include light rail transit as a mode choice. Therefore, full build out of LRT in the corridor would require modifications to the current project scope or provided as a future project. The approach in the preferred alternative has been to incorporate specific design features of the replacement bridge and approaches that support future conversion to light rail while minimizing reconstruction of the highway infrastructure. It is clear that there will be a need for construction and additional costs to add light rail to the SR 520 corridor, but the costs and risks associated with such an addition have been minimized by the design elements included in the preferred alternative. WSDOT designers have remained within the boundaries of the project scope for the preferred alternative, yet there has been a concerted effort to accommodate future light rail transit.

WSDOT designers are incorporating light rail options under several future bridge configurations. The design is such that LRT can be brought to the corridor both as a substitute for the HOV lanes (4 general purpose lanes plus 2-way LRT) and as an addition to the bridge described in the preferred alternative (4 general purpose lanes plus 2 HOV lanes plus 2-way LRT). Without a specific LRT alignment and service plan for the SR 520 corridor, the multiple design options accommodate a number of potential configurations.

What comments were received?

Many comments were received in the comment period, but most were well represented by comments provided by both the Mayor and City Council of Seattle. In summary from the Mayor's comments:

"...the A+ plan would make future conversion to light rail very difficult, if not impossible. This conclusion suggests that the A+ design does not live up to state laws, RCW 47.01.410, which mandates that the SR-520 bridge be designed to accommodate future light rail."

The comments went on to point out three specific issues with the design described in the SDEIS.

- 1) The pontoons must be designed with additional flotation and stability necessary to support the weight and dynamic loading of light rail. The project should include and bear the cost of the necessary additional pontoons.
- 2) There must be a "gap" between the eastbound and westbound lanes as the west approach reaches Foster Island to allow light rail to leave the center alignment on SR 520 to connect to Husky Stadium.
- 3) Adequate width must be maintained on the floating bridge to allow space for light rail infrastructure and operations, including emergency evacuation.

In summary, from the City Council's comments:

"We, therefore, recommend that the design for the SR 520 corridor accomplish the following in order to meet the legislative requirement to accommodate light rail:

- 1) Design substantial element of the corridor, such as overpasses of highway portions, such that they would not have to be demolished and rebuilt in order to construct light rail.*
- 2) Include the recommended gap between the eastbound and westbound lanes in the Arboretum area.*
- 3) Have a design plan that includes light rail on the current 115-foot wide bridge corridor and/or that permits adding additional width without demolishing or re-building the bridge deck.*
- 4) Ensure that the pontoons are designed so that the additional stabilization pontoons can be added without major disruption of the corridor or significant modification of the existing pontoons."*

Addressing the problem

How will we identify possible solutions?

The issues brought forth in the comment periods were directed, for the most part, to the design team for the SR 520 Project as most of the issues concern the details of the design for the bridge and approaches.

Recommendations

What did we consider?

The SR 520 design team considered how to add LRT to the corridor through replacing the HOV lanes with LRT, in a 4 general purpose lane + 2-way LRT configuration. The design team also considered how to add LRT to the corridor if future transit ridership demand indicated a need for both bus transit service operating in HOV lanes and 2-way LRT service, resulting in a 4 general purpose lane + 2 HOV lane + 2-way LRT configuration.

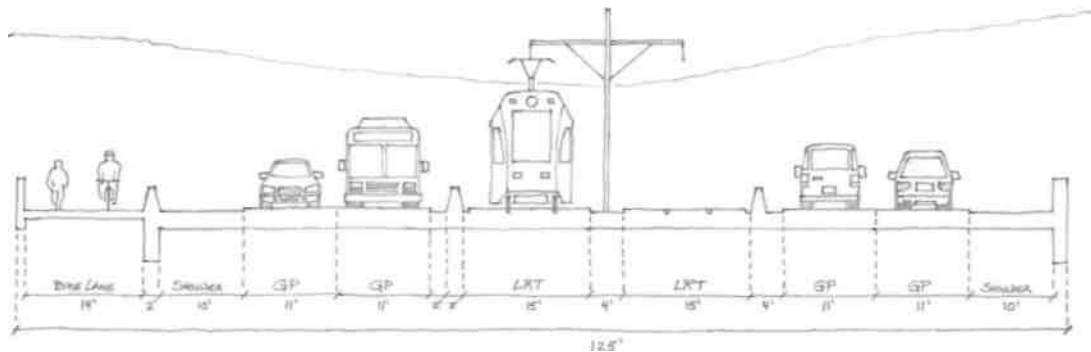
What options were presented for TCT consideration?

Using details of the report commissioned by the Mayor's office on LRT accommodation, below is a summary of how each issue has been addressed.

Bridge deck - roadway structure

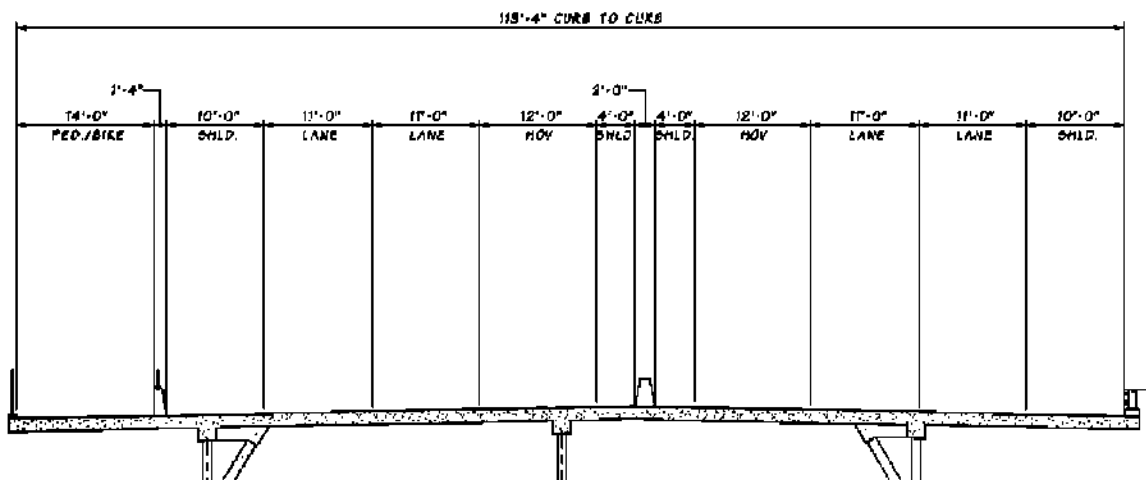
SDEIS: The report found that the roadway structure currently under design accommodates future LRT by including structural elements and stray current protection for LRT. The question that was raised was the potential need for a wider roadway structure. The report found that it could be necessary to widen the bridge deck up to ten feet, from 115 feet up to 125 feet, to support conversion to light rail. This was based on a combination of engineering factors

provided by Sound Transit and an assumption that the shoulder widths were at a minimum width that was acceptable to FHWA.

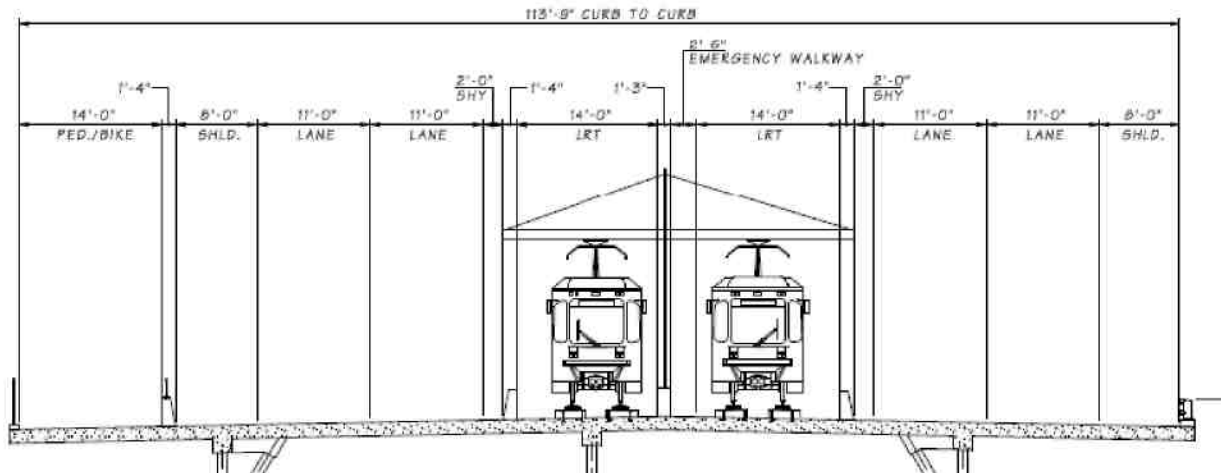


Mid-span cross section - Seattle Mayor's Report on LRT Accommodation, showing wider cross-section.

Preferred alternative resolution: In subsequent work on the design, WSDOT found that by reducing shoulder widths on the bridge deck and assuming LRT operation in a smaller design envelope (34.3 feet compared to 38 feet from outside of barrier to outside of barrier), LRT could be accommodated within a 115-foot roadway section.



Bridge mid-span cross section preferred alternative (WSDOT).



Bridge mid span cross section showing preferred alternative with HOV lanes converted to LRT, 4 GP lanes plus two LRT tracks with narrowed shoulders (WSDOT).

If light rail is added to the preferred alternative design with the 4 general purpose lanes plus 2 HOV lanes plus 2-way LRT configuration, widening of the bridge deck will be required. The outside of the bridge deck would be widened approximately 17-feet on each side. In addition, similar to the 4 general purpose lanes plus 2-way LRT configuration, the center portion of the roadway would be converted to LRT. Similar widening would also be required on the transition spans and along some segments of the approach spans.

Pontoons

SDEIS: The pontoons for the bridge as designed in the SDEIS, are capable of supporting a six-lane roadway section. The number of pontoons was insufficient to carry the six-lane roadway structure plus the added load and stability requirements necessary to accommodate LRT.

To support a six-lane structure the design includes a single string of longitudinal pontoons and supplementary stability pontoons, or "flankers," to be attached at periodic intervals to the longitudinal pontoons. The "flankers" are designed to provide the floatation and stability needed for a 6 lane roadway. With the addition of the LRT to the bridge, more flankers are needed to provide floatation and stability to accommodate the added weight and dynamic load.

Preferred alternative resolution: To support the additional loading of LRT, an additional 30 "flanker" pontoons would need to be added to the bridge. It should be noted that the technology and method for attaching these "flankers" is well known as the first phase of the six-lane bridge requires 14 "flanker" pontoons, and is the same pontoon joining process as used for all current floating bridge pontoons.

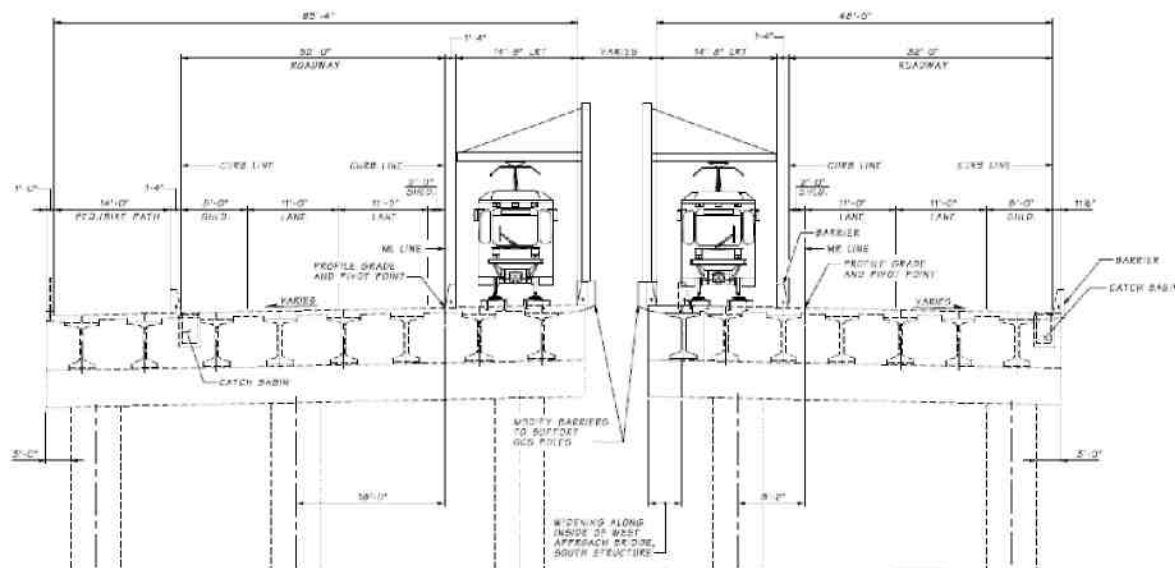
As currently defined, the project scope does not include the construction or installation of the additional 30 “flanker” pontoons necessary to support light rail. While far short of the cost of an entirely new bridge for LRT, environmental approval and the cost of the additional “flanker” pontoons would need to be part adding LRT to the SR 520 corridor.

Approaches

SDEIS: The design of the bridge approaches will require future widening and reconstruction of the structure to add light rail transit to the corridor. Similar to the floating bridge segment, the approach structures would be widened and the center portion of the bridge converted to LRT. Conversion to LRT may include demolition of the center portion to place LRT at a different profile, depending on the chosen route.

Preferred alternative resolution: The design of the east approach remains essentially the same. Current design for the Evergreen Point Transit station could accommodate LRT in the center position in the station taking the place of bus operations. Other LRT alignments which would require design and construction of a new station are also possible. The current station design would need to be adapted to provide good connectivity between buses and light rail. This station concept, likely a bi-level station, is not included in the preferred alternative. It should also be noted that some reduction of shoulder widths, consistent with reduced shoulders on the bridge, would be necessary on the east approach in the eastbound lanes to accommodate LRT if the HOV lanes are converted.

The design of the west approach has been modified to include the ability for light rail to leave the SR 520 alignment just to the east of Foster Island or approaching the Montlake Lid. This was achieved by widening the gap between eastbound and westbound lanes. Note that accommodating light rail in the west approach does require the addition of about 4 feet to the width of the structure of the eastbound lanes, as well as some widening of the bridge approach sections near the floating bridge where the gap is not provided. The structure foundation will support the 4-feet of additional width. The costs for this widening are not included in the SR 520 project for two reasons. First, there is a need to provide the narrowest structure possible to minimize adverse environmental impacts in this sensitive area. Second, the additional width cannot be justified for this project as light rail is not included as part of the project scope, only the accommodation for future light rail.



West approach east of Foster Island cross section showing preferred alternative with HOV lanes converted to LRT (showing 4 foot structural addition).

Westside shore connections

SDEIS: Light rail alignments considered in the Mayor's report as a response to the SDEIS assume a connection with the University Link station at Husky Stadium. An SR 520 light rail alignment would be designed to allow connectivity between the SR 520 light rail line and what will then be the existing U-Link light rail line. Four different options were proposed in the report for crossing the Montlake Cut:

- High-level fixed bridge
- Low-level bascule bridge
- Tunnel
- At-grade on Montlake with the second Montlake bascule bridge

Preferred alternative resolution: All four options remain open with the preferred alternative, but some of the details have been further clarified and two of the options have been enhanced. The high level bridge and tunnel options are clarified in that provisions have been made in the preferred alternative for LRT to leave the SR 520 alignment just east of Foster Island. The rail alignment, whether elevated or dropping to a tunnel, would be carried to the north of the SR 520 alignment and onto Foster Island. This has significant environmental implications. These impacts would be assessed in the environmental process related to an SR 520 light rail project. The advantage of these crossing alternatives is that the point of departure is now more clearly defined by the preferred alternative.

The low-level bascule bridge and the at-grade alternatives have been enhanced by the preferred

alternative. In both cases, assuming the 4 general purpose lane plus 2-way LRT configuration, the departure point from the SR 520 alignment has been accommodated as part of the project. The departure point could utilize the HOV/transit direct access ramps to Montlake Boulevard. These ramps have been designed with curvature and grade criteria that are compatible with light rail design and could be converted to light rail use. However, the exact track layout and necessary width of the running ways has not been designed specifically to accommodate either of these two alternatives. If either of these crossing alternatives moves forward, additional design work is necessary to determine that the ramps can, in fact, be directly converted to LRT, or that any necessary modifications to the structure have been identified.

The fourth alternative crosses the Montlake Cut on the second Montlake bascule bridge. The design of that bridge has included accommodation of light rail with some structural modifications as one of the considerations. It is anticipated that light rail would be in mixed traffic on Montlake Boulevard and on the bridge. The details of the channelization and lane configuration between the SR 520 Montlake lid and Husky Stadium have not been considered or designed. For the bascule bridge deck, the design has not encompassed the need to accommodate flush mounted light rail tracks to facilitate a shared roadway surface with motor vehicles. Stray current protection design and adequate clearance for the overhead catenary system (OCS) are also features that must be considered in the design if this crossing alternative is preferred.

What are the benefits and challenges of each recommendation?

The refinements made to the preferred alternative have accomplished two important aspects of a future potential light rail transit system added to SR 520. First, the design reduces the need for future structural modifications to accommodate LRT, and has identified the need to adapt specific aspects of the bridge for potential future LRT service. While the level of detail cannot be provided in this paper, it is worth noting that many of the lessons learned from adapting the I-90 bridge to light rail have been applied to this project, so that if the region were to decide to move forward with LRT on SR 520, many of the unknowns of I-90 are well known for SR 520. Specific design considerations have been incorporated to facilitate a more straightforward adaptation.

Second, while the costs are not specifically identified, the structural tasks necessary to add light rail have been identified and simplified.

The challenge implicit in these recommendations is two-fold. First, some of the environmental issues associated with adding light rail to the SR 520 corridor are now in much sharper focus, and some issues, such as construction on Foster Island and crossing the Montlake Cut, have serious implications for the feasibility of future LRT. Second, there is a clearer understanding of what adding LRT to the SR 520 corridor might cost. Costs to add “flanker” pontoons, widen the west approach, potentially re-design and re-construct the Evergreen Point station, and provide a crossing of the Montlake Cut could now be estimated. The environmental issues and cost implications will be important factors in any future decision process.

Final TCT recommendation

The preferred alternative incorporates specific design features on the replacement floating bridge and approaches that support future conversion to light rail while minimizing reconstruction of the highway infrastructure. The TCT endorses the work of the SR 520 design team to ensure compatibility of the corridor with potential future light rail service. Specifically, the project can accommodate future light rail in two different configurations with some capital investment, and maintain four options for connecting light rail to the UW station at Husky Stadium.